

PART 1927 [RESERVED]

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AUTHORITY: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); and Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), 1-90 (55 FR 9033), 6-96 (62 FR 111), 3-2000 (65 FR 50017), 5-2002 (67 FR 65008), or 4-2010 (75 FR 55355), as applicable; and 29 CFR 1911.

Section 1928.21 also issued under 49 U.S.C. 1801-1819 and 5 U.S.C. 533.

SOURCE: 40 FR 18257, Apr. 25, 1975, unless otherwise noted.

Subpart A—General

§ 1928.1 Purpose and scope.

This part contains occupational safety and health standards applicable to agricultural operations.

Subpart B—Applicability of Standards

§ 1928.21 Applicable standards in 29 CFR part 1910.

(a) The following standards in part 1910 of this chapter shall apply to agricultural operations:

- (1) Temporary labor camps—§ 1910.142;
- (2) Storage and handling of anhydrous ammonia—§ 1910.111 (a) and (b);
- (3) Logging operations—§ 1910.266;
- (4) Slow-moving vehicles—§ 1910.145;
- (5) Hazard communication—§ 1910.1200;
- (6) Cadmium—§ 1910.1027.
- (7) Retention of DOT markings, placards and labels—§ 1910.1201.

(b) Except to the extent specified in paragraph (a) of this section, the standards contained in subparts B through T and subpart Z of part 1910 of this title do not apply to agricultural operations.

(Section 1928.21 contains a collection of information which has been approved by the Office of Management and Budget under OMB control number 1218-0072)

[40 FR 18257, Apr. 25, 1975, as amended at 42 FR 38569, July 29, 1977; 52 FR 31886, Aug. 24, 1987; 59 FR 36700, July 19, 1994; 59 FR 51748, Oct. 12, 1994; 61 FR 5510, Feb. 13, 1996; 61 FR 9255, Mar. 7, 1996]

Subpart C—Roll-Over Protective Structures

§ 1928.51 Roll-over protective structures (ROPS) for tractors used in agricultural operations.

(a) *Definitions.* As used in this subpart—

Agricultural tractor means a two- or four-wheel drive type vehicle, or track vehicle, of more than 20 engine horsepower, designed to furnish the power to pull, carry, propel, or drive implements that are designed for agriculture. All self-propelled implements are excluded.

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Low profile tractor means a wheeled tractor possessing the following characteristics:

(1) The front wheel spacing is equal to the rear wheel spacing, as measured from the centerline of each right wheel to the centerline of the corresponding left wheel.

(2) The clearance from the bottom of the tractor chassis to the ground does not exceed 18 inches.

(3) The highest point of the hood does not exceed 60 inches, and

(4) The tractor is designed so that the operator straddles the transmission when seated.

Tractor weight includes the protective frame or enclosure, all fuels, and other components required for normal use of the tractor. Ballast shall be added as necessary to achieve a minimum total weight of 110 lb. (50.0 kg.) per maximum power take-off horsepower at the rated engine speed or the maximum gross vehicle weight specified by the manufacturer, whichever is the greatest. Front end weight shall be at least 25 percent of the tractor test weight. In case power take-off horsepower is not available, 95 percent of net engine flywheel horsepower shall be used.

(b) *General requirements.* Agricultural tractors manufactured after October 25, 1976, shall meet the following requirements:

(1) *Roll-over protective structures (ROPS).* ROPS shall be provided by the employer for each tractor operated by an employee. Except as provided in paragraph (b)(5) of this section, a ROPS used on wheel-type tractors shall meet the test and performance requirements of 29 CFR 1928.52, 1928.53, or 1926.1002 as appropriate. A ROPS used on track-type tractors shall meet the test and performance requirements of 29 CFR 1926.1001.

(2) *Seatbelts.* (i) Where ROPS are required by this section, the employer shall:

(A) Provide each tractor with a seatbelt which meets the requirements of this paragraph;

(B) Ensure that each employee uses such seatbelt while the tractor is moving; and

(C) Ensure that each employee tightens the seatbelt sufficiently to

confine the employee to the protected area provided by the ROPS.

(ii) Each seatbelt shall meet the requirements set forth in Society of Automotive Engineers Standard SAE J4C, 1965 Motor Vehicle Seat Belt Assemblies,² except as noted hereafter:

(A) Where a suspended seat is used, the seatbelt shall be fastened to the movable portion of the seat to accommodate a ride motion of the operator.

(B) The seatbelt anchorage shall be capable of withstanding a static tensile load of 1,000 pounds (453.6 kg) at 45 degrees to the horizontal equally divided between the anchorages. The seat mounting shall be capable of withstanding this load plus a load equal to four times the weight of all applicable seat components applied at 45 degrees to the horizontal in a forward and upward direction. In addition, the seat mounting shall be capable of withstanding a 500 pound (226.8 kg) belt load plus two times the weight of all applicable seat components both applied at 45 degrees to the horizontal in and upward and rearward direction. Floor and seat deformation is acceptable provided there is not structural failure or release of the seat adjusted mechanism or other locking device.

(C) The seatbelt webbing material shall have a resistance to acids, alkalis, mildew, aging, moisture, and sunlight equal to or better than that of untreated polyester fiber.

(3) *Protection from spillage.* Batteries, fuel tanks, oil reservoirs, and coolant systems shall be constructed and located or sealed to assure that spillage will not occur which may come in contact with the operator in the event of an upset.

(4) *Protection from sharp surfaces.* All sharp edges and corners at the operator's station shall be designed to minimize operator injury in the event of an upset.

(5) *Exempted uses.* Paragraphs (b)(1) and (b)(2) of this section do not apply to the following uses:

(i) *Low profile* tractors while they are used in orchards, vineyards or hop

²Copies may be obtained from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

yards where the vertical clearance requirements would substantially interfere with normal operations, and while their use is incidental to the work performed therein.

(ii) *Low profile* tractors while used inside a farm building or greenhouse in which the vertical clearance is insufficient to allow a ROPS equipped tractor to operate, and while their use is incidental to the work performed therein.

(iii) Tractors while used with mounted equipment which is incompatible with ROPS (e.g. cornpickers, cotton strippers, vegetable pickers and fruit harvesters).

(6) *Remounting*. Where ROPS are removed for any reason, they shall be remounted so as to meet the requirements of this paragraph.

(c) *Labeling*. Each ROPS shall have a label, permanently affixed to the structure, which states:

(1) Manufacturer's or fabricator's name and address;

(2) ROPS model number, if any;

(3) Tractor makes, models, or series numbers that the structure is designed to fit; and

(4) That the ROPS model was tested in accordance with the requirements of this subpart.

(d) *Operating instructions*. Every employee who operates an agricultural tractor shall be informed of the operating practices contained in appendix A of this part and of any other practices dictated by the work environment. Such information shall be provided at the time of initial assignment and at least annually thereafter.

[40 FR 18257, Apr. 25, 1975, as amended at 61 FR 9255, Mar. 7, 1996; 69 FR 18803, Apr. 9, 2004; 70 FR 77003, Dec. 29, 2005]

§ 1928.52 Protective frames for wheel-type agricultural tractors—test procedures and performance requirements.

(a) *Purpose*. The purpose of this section is to establish the test and performance requirements for a protective frame designed for wheel-type agricultural tractors to minimize the frequency and severity of operator injury resulting from accidental upsets. General requirements for the protection of operators are specified in 29 CFR 1928.51.

(b) *Types of tests*. All protective frames for wheel-type agricultural tractors shall be of a model that has been tested as follows:

(1) *Laboratory test*. A laboratory energy-absorption test, either static or dynamic, under repeatable and controlled loading, to permit analysis of the protective frame for compliance with the performance requirements of this standard.

(2) *Field-upset test*. A field-upset test under controlled conditions, both to the side and rear, to verify the effectiveness of the protective system under actual dynamic conditions. Such testing may be omitted when:

(i) The analysis of the protective-frame static-energy absorption test results indicates that both FER_{is} and FER_{ir} (as defined in paragraph (d)(2)(ii) of this section) exceed 1.15; or

(ii) The analysis of the protective-frame dynamic-energy absorption test results indicates that the frame can withstand an impact of 15 percent greater than the impact it is required to withstand for the tractor weight as shown in Figure C-7.

(c) *Descriptions*—(1) *Protective frame*. A protective frame is a structure comprised of uprights mounted to the tractor, extending above the operator's seat. A typical two-post frame is shown in Figure C-1.

(2) *Overhead weather shield*. When an overhead weather shield is available for attachment to the protective frame, it may be in place during tests provided it does not contribute to the strength of the protective frame.

(3) *Overhead falling object protection*. When an overhead falling-object protection device is available for attachment to the protective frame, it may be in place during tests provided it does not contribute to the strength of the protective frame.

(d) *Test procedures*—(1) *General*. (i) The tractor weight used shall be that of the heaviest tractor model on which the protective frame is to be used.

(ii) Each test required under this section shall be performed on a new protective frame. Mounting connections of the same design shall be used during each such test.

(iii) Instantaneous deflection shall be measured and recorded for each segment of the test; see paragraph (e)(1)(i) of this section for permissible deflections.

(iv) The seat-reference point (“SRP”) in Figure C–3 is that point where the vertical line that is tangent to the most forward point at the longitudinal seat centerline of the seat back, and the horizontal line that is tangent to the highest point of the seat cushion, intersect in the longitudinal seat section. The seat-reference point shall be determined with the seat unloaded and adjusted to the highest and most rearward position provided for seated operation of the tractor.

(v) When the centerline of the seat is off the longitudinal center, the frame loading shall be on the side with the least space between the centerline of seat and the protective frame.

(vi) Low-temperature characteristics of the protective frame or its material shall be demonstrated as specified in paragraph (e)(1)(ii) of this section.

(vii) Rear input energy tests (static, dynamic, or field-upset) need not be performed on frames mounted to tractors having four driven wheels and more than one-half their unballasted weight on the front wheels.

(viii) Accuracy table:

Measurements	Accuracy
Deflection of the frame, in. (mm).	±5 percent of the deflection measured.
Vertical weight, lb (kg)	±5 percent of the weight measured.
Force applied to the frame, pounds force (newtons).	±5 percent of the force measured.
Dimensions of the critical zone, in. (mm).	±0.5 in. (12.5 mm).

(2) *Static test procedure.* (i) The following test conditions shall be met:

(A) The laboratory mounting base shall be the tractor chassis for which the protective frame is designed, or its equivalent;

(B) The protective frame shall be instrumented with the necessary equipment to obtain the required load-deflection data at the locations and directions specified in Figures C–2 and C–3; and

(C) When the protective frame is of a one- or two-upright design, mounting connections shall be instrumented with the necessary equipment to record the

required force to be used in paragraph (d)(2)(iii)(E) and (J) of this section. Instrumentation shall be placed on mounting connections before installation load is applied.

(ii) The following definitions shall apply:

W = Tractor weight (see 29 CFR 1928.51(a)) in lb (W' in kg);

E_{is} = Energy input to be absorbed during side loading in ft-lb (E'_{is} in J [joules]);

$E_{is} = 723 + 0.4 W$ ($E'_{is} = 100 + 0.12 W'$);

E_{ir} = Energy input to be absorbed during rear loading in ft-lb (E'_{ir} in J);

$E_{ir} = 0.47 W$ ($E'_{ir} = 0.14 W'$);

L = Static load, lbf [pounds force], (N) [newtons];

D = Deflection under L , in. (mm);

L - D = Static load-deflection diagram;

L_{max} = Maximum observed static load;

Load Limit = Point on a continuous L - D curve where the observed static load is 0.8 L_{max} on the down slope of the curve (see Figure C–5);

E_u = Strain energy absorbed by the frame in ft-lb (J); area under the L - D curve;

FER = Factor of energy ratio;

$FER_{is} = E_u E_{is}$;

$FER_{ir} = E_u E_{ir}$;

P_b = Maximum observed force in mounting connection under a static load, L lbf (N);

P_u = Ultimate force capacity of a mounting connection, lbf (N);

FSB = Design margin for a mounting connection; and

$FSB = P_u/P_b$

(iii) The test procedures shall be as follows:

(A) Apply the rear load according to Figure C–3, and record L and D simultaneously. Rear-load application shall be distributed uniformly on the frame over an area perpendicular to the direction of load application, no greater than 160 sq. in. (1,032 sq. cm) in size, with the largest dimension no greater than 27 in. (686 mm). The load shall be applied to the upper extremity of the frame at the point that is midway between the center of the frame and the inside of the frame upright. When no structural cross member exists at the rear of the frame, a substitute test beam that does not add strength to the frame may be used to complete this test procedure. The test shall be stopped when:

(1) The strain energy absorbed by the frame is equal to or greater than the required input energy E_{ir} ; or

(2) Deflection of the frame exceeds the allowable deflection (see paragraph (e)(1)(i) of this section); or

(3) Frame load limit occurs before the allowable deflection is reached in rear load (see Figure C-5).

(B) Using data obtained under paragraph (d)(2)(iii)(A) of this section, construct the *L-D* diagram shown in Figure C-5;

(C) Calculate E_{ir} ;

(D) Calculate FER_{ir} ;

(E) Calculate FSB as required by paragraph (d)(2)(i)(C) of this section;

(F) Apply the side-load tests on the same frame, and record *L* and *D* simultaneously. Side-load application shall be at the upper extremity of the frame at a 90° angle to the centerline of the vehicle. The side load shall be applied to the longitudinal side farthest from the point of rear-load application. Apply side load *L* as shown in Figure C-2. The test shall be stopped when:

(1) The strain energy absorbed by the frame is equal to or greater than the required input energy E_{is} ; or

(2) Deflection of the frame exceeds the allowable deflection (see paragraph (e)(1)(i) of this section); or

(3) Frame load limit occurs before the allowable deflection is reached in side load (see Figure C-5).

(G) Using data obtained in paragraph (d)(2)(iii)(F) of this section, construct the *L-D* diagram as shown in Figure C-5;

(H) Calculate E_{is} ;

(I) Calculate FER_{is} ; and

(J) Calculate FSB as required by paragraph (d)(2)(i)(C) of this section.

(3) *Dynamic test procedure.* (i) The following test conditions shall be met:

(A) The protective frame and tractor shall be tested at the weight defined by 29 CFR 1928.51(a);

(B) The dynamic loading shall be accomplished by using a 4,410-lb (2,000-kg) weight acting as a pendulum. The impact face of the weight shall be 27 ± 1 in. by 27 ± 1 in. (686 ± 25 mm by 686 ± 25 mm), and shall be constructed so that its center of gravity is within 1.0 in. (25.4 mm) of its geometric center. The weight shall be suspended from a pivot point 18 to 22 ft (5.5 to 6.7 m) above the point of impact on the frame, and shall be conveniently and safely adjustable for height (see Figure C-6);

(C) For each phase of testing, the tractor shall be restrained from moving when the dynamic load is applied. The restraining members shall have strength no less than, and elasticity no greater than, that of 0.50-in. (12.7-mm) steel cable. Points of attachment for the restraining members shall be located an appropriate distance behind the rear axle and in front of the front axle to provide a 15° to 30° angle between a restraining cable and the horizontal. For impact from the rear, the restraining cables shall be located in the plane in which the center of gravity of the pendulum will swing, or alternatively, two sets of symmetrically located cables may be used at lateral locations on the tractor. For impact from the side, restraining cables shall be used as shown in Figures C-8 and C-9;

(D) The front and rear wheel-tread settings, when adjustable, shall be at the position nearest to halfway between the minimum and maximum settings obtainable on the vehicle. When only two settings are obtainable, the minimum setting shall be used. The tires shall have no liquid ballast, and shall be inflated to the maximum operating pressure recommended by the manufacturer. With the specified tire inflation, the restraining cable shall be tightened to provide tire deflection of 6 to 8 percent of the nominal tire-section width. After the vehicle is restrained properly, a wooden beam no less than 6-in. × 6-in. (150-mm × 150-mm) in cross section shall be driven tightly against the appropriate wheels and clamped. For the test to the side, an additional wooden beam shall be placed as a prop against the wheel nearest to the operator's station, and shall be secured to the base so that it is held tightly against the wheel rim during impact. The length of this beam shall be chosen so that it is at an angle of 25° to 40° to the horizontal when it is positioned against the wheel rim. It shall have a length 20 to 25 times its depth, and a width two to three times its depth (see Figures C-8 and C-9);

(E) Means shall be provided for indicating the maximum instantaneous deflection along the line of impact. A simple friction device is illustrated in Figure C-4;

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(F) No repairs or adjustments shall be made during the test; and

(G) When any cables, props, or blocking shift or break during the test, the test shall be repeated.

(ii) H = Vertical height of the center of gravity of a 4,410-lb (2,000-kg) weight in in. (H' in mm). The weight shall be pulled back so that the height of its center of gravity above the point of impact is: $H = 4.92 + 0.00190 W$ ($H' = 125 \pm 0.170 W'$) (see Figure C-7).

(iii) The test procedures shall be as follows:

(A) The frame shall be evaluated by imposing dynamic loading from the rear, followed by a load to the side on the same frame. The pendulum swinging from the height determined by paragraph (d)(3)(ii) of this section shall be used to impose the dynamic load. The position of the pendulum shall be so selected that the initial point of impact on the frame is in line with the arc of travel of the center of gravity of the pendulum. When a quick-release mechanism is used, it shall not influence the attitude of the block;

(B) *Impact at rear.* The tractor shall be restrained properly according to paragraphs (d)(3)(i)(C) and (d)(3)(i)(D) of this section. The tractor shall be positioned with respect to the pivot point of the pendulum so that the pendulum is 20° from the vertical prior to impact as shown in Figure C-8. The impact shall be applied to the upper extremity of the frame at the point that is midway between the centerline of the frame and the inside of the frame upright. When no structural cross member exists at the rear of the frame, a substitute test beam that does not add to the strength of the frame may be used to complete the test procedure; and

(C) *Impact at side.* The blocking and restraining shall conform to paragraphs (d)(3)(i)(C) and (d)(3)(i)(D) of this section. The center point of impact shall be at the upper extremity of the frame at a point most likely to hit the ground first, and at a 90° to the centerline of the vehicle (see Figure C-9). The side impact shall be applied to the longitudinal side farthest from the point of rear impact.

(4) *Field-upset test procedure.* (i) The following test conditions shall be met:

(A) The tractor shall be tested at the weight defined in 29 CFR 1928.51(a);

(B) The following provisions address soil bank test conditions.

(1) The test shall be conducted on a dry, firm soil bank. The soil in the impact area shall have an average cone index in the 0-in. to 6-in. (0-mm to 152-mm) layer of not less than 150. Cone index shall be determined according to American Society of Agricultural Engineers ("ASAE") recommendation ASAE R313.1-1971 ("Soil cone penetrometer"), as reconfirmed in 1975, which is incorporated by reference. The incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. The path of vehicle travel shall be $12^\circ \pm 2^\circ$ to the top edge of the bank.

(2) ASAE recommendation R313.1-1971, as reconfirmed in 1975, appears in the 1977 Agricultural Engineers Yearbook, or it may be examined at: Any OSHA Regional Office; the OSHA Docket Office, U.S. Department of Labor, 200 Constitution Avenue, NW., Room N-2625, Washington, DC 20210 (telephone: (202) 693-2350 (TTY number: (877) 889-5627)); or the National Archives and Records Administration ("NARA"). (For information on the availability of this material at NARA, telephone (202) 741-6030 or access the NARA Web site at [http://www.archives.gov/federal_register/](http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html)

[code_of_federal_regulations/ibr_locations.html](http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html).) Copies may be purchased from the American Society of Agricultural Engineers, 2950 Niles Road, St. Joseph, MI 49085.

(C) An 18-in. (457-mm) high ramp (see Figure C-10) shall be used to assist in upsetting the vehicle to the side; and

(D) The front and rear wheel-tread settings, when adjustable, shall be at the position nearest to halfway between the minimum and maximum settings obtainable on the vehicle. When only two settings are obtainable, the minimum setting shall be used.

(ii) Field upsets shall be induced to the rear and side as follows:

(A) Rear upset shall be induced by engine power, with the tractor operating in gear to obtain 3 to 5 mph (4.8 to 8.0 kph) at maximum governed engine rpm by driving forward directly up

a minimum slope of $60^\circ \pm 5^\circ$ as shown in Figure C-11, or by an alternative equivalent means. The engine clutch may be used to aid in inducing the upset; and

(B) To induce side upset, the tractor shall be driven under its own power along the specified path of travel at a minimum speed of 10 mph (16 kph), or at maximum vehicle speed when under 10 mph (16 kph), and over the ramp as described in paragraph (d)(4)(i)(C) of this section.

(e) *Performance requirements*—(1) *General requirements.* (i) The frame, overhead weather shield, fenders, or other parts in the operator area may be deformed in these tests, but shall not shatter or leave sharp edges exposed to the operator, or encroach on the dimensions shown in Figures C-2 and C-3, and specified as follows:

d = 2 in. (51 mm) inside of the frame upright to the vertical centerline of the seat;

e = 30 in. (762 mm) at the longitudinal centerline;

f = Not greater than 4 in. (102 mm) to the rear edge of the crossbar, measured forward of the seat-reference point (“SRP”);

g = 24 in. (610 mm) minimum; and

m = Not greater than 12 in. (305 mm), measured from the seat-reference point to the forward edge of the crossbar.

(ii) The protective structure and connecting fasteners must pass the static or dynamic tests described in paragraphs (d)(2), (d)(3), or (d)(4) of this section at a metal temperature of 0°F (-18°C) or below, or exhibit Charpy V-notch impact strengths as follows:

10-mm \times 10-mm (0.394-in. \times 0.394-in.) specimen: 8.0 ft-lb (10.8 J) at -20°F (-30°C);
 10-mm \times 7.5-mm (0.394-in. \times 0.296-in.) specimen: 7.0 ft-lb (9.5 J) at -20°F (-30°C);
 10-mm \times 5-mm (0.394-in. \times 0.197-in.) specimen: 5.5 ft-lb (7.5 J) at -20°F (-30°C); or
 10-mm \times 2.5-mm (0.394-in. \times 0.098-in.) specimen: 4.0 ft-lb (5.5 J) at -20°F (-30°C).

Specimens shall be longitudinal and taken from flat stock, tubular, or structural sections before forming or welding for use in the frame. Specimens from tubular or structural sections shall be taken from the middle of the side of greatest dimension, not to include welds.

(2) *Static test-performance requirements.* In addition to meeting the requirements of paragraph (e)(1) of this section for both side and rear loads, FER_{is} and FER_{ir} , shall be greater than 1.0, and

when the ROPS contains one or two upright frames only, FSB shall be greater than 1.3.

(3) *Dynamic test-performance requirements.* The structural requirements shall be met when the dimensions in paragraph (e)(1) of this section are used in both side and rear loads.

(4) *Field-upset test performance requirements.* The requirements of paragraph (e)(1) of this section shall be met for both side and rear upsets.

[70 FR 77004, Dec. 29, 2005]

§ 1928.53 Protective enclosures for wheel-type agricultural tractors—test procedures and performance requirements.

(a) *Purpose.* The purpose of this section is to establish the test and performance requirements for a protective enclosure designed for wheel-type agricultural tractors to minimize the frequency and severity of operator injury resulting from accidental upset. General requirements for the protection of operators are specified in 29 CFR 1928.51.

(b) *Types of tests.* All protective enclosures for wheel-type agricultural tractors shall be of a model that has been tested as follows:

(1) *Laboratory test.* A laboratory energy-absorption test, either static or dynamic, under repeatable and controlled loading, to permit analysis of the protective enclosure for compliance with the performance requirements of this standard; and

(2) *Field-upset test.* A field-upset test under controlled conditions, both to the side and rear, to verify the effectiveness of the protective system under actual dynamic conditions. This test may be omitted when:

(i) The analysis of the protective-frame static-energy absorption test results indicates that both FER_{is} and FER_{ir} (as defined in paragraph (d)(2)(ii) of this section) exceed 1.15; or

(ii) The analysis of the protective-frame dynamic-energy absorption test results indicates that the frame can withstand an impact 15 percent greater than the impact it is required to withstand for the tractor weight as shown in Figure C-7.

(c) *Description.* A protective enclosure is a structure comprising a frame and/

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or enclosure mounted to the tractor. A typical enclosure is shown in Figure C–12.

(d) *Test procedures*—(1) *General*. (i) The tractor weight used shall be that of the heaviest tractor model on which the protective enclosure is to be used.

(ii) Each test required under this section shall be performed on a protective enclosure with new structural members. Mounting connections of the same design shall be used during each test.

(iii) Instantaneous deflection shall be measured and recorded for each segment of the test; see paragraph (e)(1)(i) of this section for permissible deflections.

(iv) The seat-reference point (“SRP”) in Figure C–14 is that point where the vertical line that is tangent to the most forward point at the longitudinal seat centerline of the seat back, and the horizontal line that is tangent to the highest point of the seat cushion, intersect in the longitudinal seat section. The seat-reference point shall be determined with the seat unloaded and adjusted to the highest and most rearward position provided for seated operations of the tractor.

(v) When the centerline of the seat is off the longitudinal center, the protective-enclosure loading shall be on the side with least space between the centerline of the seat and the protective enclosure.

(vi) Low-temperature characteristics of the protective enclosure or its material shall be demonstrated as specified in paragraph (e)(1)(ii) of this section.

(vii) Rear input energy tests (static, dynamic, or field-upset) need not be performed on enclosures mounted to tractors having four driven wheels and more than one-half their unballasted weight on the front wheels.

(viii) Accuracy table:

Measurements	Accuracy
Deflection of the enclosure, in. (mm).	±5 percent of the deflection measured.
Vertical weight, pounds (kg) ..	±5 percent of the weight measured.
Force applied to the enclosure, pounds force (newtons).	±5 percent of the force measured.
Dimensions of the critical zone, in. (mm).	±0.5 in. (12.5 mm).

(ix) When movable or normally removable portions of the enclosure add to structural strength, they shall be placed in configurations that contribute least to structural strength during the test.

(2) *Static test procedure*. (i) The following test conditions shall be met:

(A) The laboratory mounting base shall be the tractor chassis for which the protective enclosure is designed, or its equivalent; and

(B) The protective enclosure shall be instrumented with the necessary equipment to obtain the required load-deflection data at the locations and directions specified in Figures C–13 and C–14.

(ii) The following definitions shall apply:

W = Tractor weight (see 29 CFR 1928.51(a)) in lb (W'' in kg);

E_{is} = Energy input to be absorbed during side loading in ft-lb (E''_{is} in J [joules]);

$E_{is} = 723 + 0.4 W$ ($E''_{is} = 100 + 0.12 W''$);

E_{ir} = Energy input to be absorbed during rear loading in ft-lb (E''_{ir} in J);

$E_{ir} = 0.47 W$ ($E''_{ir} = 0.14 W''$);

L = Static load, lbf [pounds force], (N) [newtons];

D = Deflection under L , in. (mm);

L – D = Static load-deflection diagram;

L_{max} = Maximum observed static load;

Load Limit = Point on a continuous L – D curve where the observed static load is 0.8 L_{max} on the down slope of the curve (see Figure C–5);

E_u = Strain energy absorbed by the protective enclosure in ft-lbs (J); area under the L – D curve;

FER = Factor of energy ratio;

$FER_{is} = E_u/E_{is}$; and

$FER_{ir} = E_u/E_{ir}$.

(iii) The test procedures shall be as follows:

(A) When the protective-frame structures are not an integral part of the enclosure, the direction and point of load application for both side and rear shall be the same as specified in 29 CFR 1928.52(d)(2);

(B) When the protective-frame structures are an integral part of the enclosure, apply the rear load according to Figure C–14, and record L and D simultaneously. Rear-load application shall be distributed uniformly on the frame structure over an area perpendicular to the load application, no greater than 160 sq. in. (1,032 sq. cm) in size, with the largest dimension no greater than 27

in. (686 mm). The load shall be applied to the upper extremity of the structure at the point that is midway between the centerline of the protective enclosure and the inside of the protective structure. When no structural cross member exists at the rear of the enclosure, a substitute test beam that does not add strength to the structure may be used to complete this test procedure. The test shall be stopped when:

(1) The strain energy absorbed by the structure is equal to or greater than the required input energy E_{ir} ; or

(2) Deflection of the structure exceeds the allowable deflection (see paragraph (e)(1)(i) of this section); or

(3) The structure load limit occurs before the allowable deflection is reached in rear load (see Figure C-5);

(C) Using data obtained in paragraph (d)(2)(iii)(B) of this section, construct the *L-D* diagram for rear loads as shown in Figure C-5;

(D) Calculate E_{ir} ;

(E) Calculate FER_{ir} ;

(F) When the protective-frame structures are an integral part of the enclosure, apply the side load according to Figure C-13, and record *L* and *D* simultaneously. Static side-load application shall be distributed uniformly on the frame over an area perpendicular to the direction of load application, and no greater than 160 sq. in. (1,032 sq. cm) in size, with the largest dimension no greater than 27 in. (686 mm). Side-load application shall be at a 90° angle to the centerline of the vehicle. The center of the side-load application shall be located between point *k*, 24 in. (610 mm) forward of the seat-reference point, and point *l*, 12 in. (305 mm) rearward of the seat-reference point, to best use the structural strength (see Figure C-13). This side load shall be applied to the longitudinal side farthest from the point of rear-load application. The test shall be stopped when:

(1) The strain energy absorbed by the structure is equal to or greater than the required input energy E_{is} ; or

(2) Deflection of the structure exceeds the allowable deflection (see paragraph (e)(1)(i) of this section); or

(3) The structure load limit occurs before the allowable deflection is reached in side load (see Figure C-5);

(G) Using data obtained in paragraph (d)(2)(iii)(F) of this section, construct the *L-D* diagram for the side load as shown in Figure C-5;

(H) Calculate FER_{is} ; and

(I) Calculate FER_{ir} .

(3) *Dynamic test procedure.* (i) The following test conditions shall be met:

(A) The protective enclosure and tractor shall be tested at the weight defined by 29 CFR 1928.51(a);

(B) The dynamic loading shall be accomplished by using a 4,410-lb (2,000-kg) weight acting as a pendulum. The impact face of the weight shall be 27 ±1 in. by 27 ±1 in. (686 ±25 mm by 686 ±25 mm), and shall be constructed so that its center of gravity is within 1.0 in. (25.4 mm) of its geometric center. The weight shall be suspended from a pivot point 18 to 22 ft (5.5 to 6.7 m) above the point of impact on the enclosure, and shall be conveniently and safely adjustable for height (see Figure C-6);

(C) For each phase of testing, the tractor shall be restrained from moving when the dynamic load is applied. The restraining members shall have strength no less than, and elasticity no greater than, that of 0.50-in. (12.7-mm) steel cable. Points of attachment for the restraining members shall be located an appropriate distance behind the rear axle and in front of the front axle to provide a 15° to 30° angle between the restraining cable and the horizontal. For impact from the rear, the restraining cables shall be located in the plane in which the center of gravity of the pendulum will swing, or alternatively, two sets of symmetrically located cables may be used at lateral locations on the tractor. For the impact from the side, restraining cables shall be used as shown in Figures C-15 and C-16;

(D) The front and rear wheel-tread settings, when adjustable, shall be at the position nearest to halfway between the minimum and maximum settings obtainable on the vehicle. When only two settings are obtainable, the minimum setting shall be used. The tires shall have no liquid ballast, and shall be inflated to the maximum operating pressure recommended by the manufacturer. With specified tire inflation, the restraining cable shall be tightened to provide tire deflection of 6

to 8 percent of nominal tire section width. After the vehicle is restrained properly, a wooden beam no smaller than 6-in. × 6-in. (150-mm × 150-mm) cross-section shall be driven tightly against the appropriate wheels and clamped. For the test to the side, an additional wooden beam shall be placed as a prop against the wheel nearest the operator's station, and shall be secured to the base so that it is held tightly against the wheel rim during impact. The length of this beam shall be chosen so that it is at an angle of 25° to 40° to the horizontal when it is positioned against the wheel rim. It shall have a length 20 to 25 times its depth, and a width two to three times its depth (see Figures C-15 and C-16);

(E) Means shall be provided for indicating the maximum instantaneous deflection along the line of impact. A simple friction device is illustrated in Figure C-4;

(F) No repair or adjustments shall be made during the test; and

(G) When any cables, props, or blocking shift or break during the test, the test shall be repeated.

(ii) H = Vertical height of the center of gravity of a 4,410-lb (2,000-kg) weight in in. (H' in mm). The weight shall be pulled back so that the height of its center of gravity above the point of impact is: $H = 4.92 + 0.00190 W$ ($H' = 125 + 0.107 W'$) (see Figure C-7).

(iii) The test procedures shall be as follows:

(A) The enclosure structure shall be evaluated by imposing dynamic loading from the rear, followed by a load to the side on the same enclosure structure. The pendulum swinging from the height determined by paragraph (d)(3)(ii) of this section shall be used to impose the dynamic load. The position of the pendulum shall be so selected that the initial point of impact on the protective structure is in line with the arc of travel of the center of gravity of the pendulum. When a quick-release mechanism is used, it shall not influence the attitude of the block;

(B) *Impact at rear.* The tractor shall be restrained properly according to paragraphs (d)(3)(i)(C) and (d)(3)(i)(D) of this section. The tractor shall be positioned with respect to the pivot point of the pendulum so that the pendulum

is 20° from the vertical prior to impact as shown in Figure C-15. The impact shall be applied to the upper extremity of the enclosure structure at the point that is midway between the centerline of the enclosure structure and the inside of the protective structure. When no structural cross member exists at the rear of the enclosure structure, a substitute test beam that does not add to the strength of the structure may be used to complete the test procedure; and

(C) *Impact at side.* The blocking and restraining shall conform to paragraphs (d)(3)(i)(C) and (d)(3)(i)(D) of this section. The center point of impact shall be at the upper extremity of the enclosure at a 90° angle to the centerline of the vehicle, and located between a point k , 24 in. (610 mm) forward of the seat-reference point, and a point l , 12 in. (305 mm) rearward of the seat-reference point, to best use the structural strength (see Figure C-13). The side impact shall be applied to the longitudinal side farthest from the point of rear impact.

(4) *Field-upset test procedure.* (i) The following test conditions shall be met:

(A) The tractor shall be tested at the weight defined in 29 CFR 1928.51(a);

(B) The following provisions address soil bank test conditions.

(1) The test shall be conducted on a dry, firm soil bank. The soil in the impact area shall have an average cone index in the 0-in. to 6-in. (0-mm to 152-mm) layer of not less than 150. Cone index shall be determined according to American Society of Agricultural Engineers ("ASAE") recommendation ASAE R313.1-1971 ("Soil cone penetrometer"), as reconfirmed in 1975, which is incorporated by reference. The incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. The path of vehicle travel shall be 12° ± 2° to the top edge of the bank.

(2) ASAE recommendation R313.1-1971, as reconfirmed in 1975, appears in the 1977 Agricultural Engineers Yearbook, or it may be examined at: Any OSHA Regional Office; the OSHA Docket Office, U.S. Department of Labor, 200 Constitution Avenue, NW., Room

N-2625, Washington, DC 20210 (telephone: (202) 693-2350 (TTY number: (877) 889-5627)); or the National Archives and Records Administration ("NARA"). (For information on the availability of this material at NARA, telephone (202) 741-6030 or access the NARA Web site at http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.) Copies may be purchased from the American Society of Agricultural Engineers 2950 Niles Road, St. Joseph, MI 49085.

(C) An 18-in. (457 mm) high ramp (see Figure C-10) shall be used to assist in upsetting the vehicle to the side; and

(D) The front and rear wheel-tread settings, when adjustable, shall be at the position nearest to halfway between the minimum and maximum settings obtainable on the vehicle. When only two settings are obtainable, the minimum setting shall be used.

(ii) Field upsets shall be induced to the rear and side.

(A) Rear upset shall be induced by engine power, with the tractor operating in gear to obtain 3 to 5 mph (4.8 to 8.0 kph) at maximum governed engine rpm by driving forward directly up a minimum slope of $60^\circ \pm 5^\circ$ as shown in Figure C-11, or by an alternate equivalent means. The engine clutch may be used to aid in inducing the upset; and

(B) To induce side upset, the tractor shall be driven under its own power along the specified path of travel at a minimum speed of 10 mph (16 kph), or at maximum vehicle speed when under 10 mph (16 kph), and over the ramp as described in paragraph (d)(4)(i)(C) of this section.

(e) *Performance requirements*—(1) *General requirements*. (i) The protective enclosure structural members or other parts in the operator area may be deformed in these tests, but shall not shatter or leave sharp edges exposed to the operator. They shall not encroach on a transverse plane passing through points *d* and *f* within the projected area defined by dimensions *d*, *e*, and *g*, or on the dimensions shown in Figures C-13 and C-14, as follows:

d = 2 in. (51 mm) inside of the protective structure to the vertical centerline of the seat;

e = 30 in. (762 mm) at the longitudinal centerline;

f = Not greater than 4 in. (102 mm) measured forward of the seat-reference point ("SRP") at the longitudinal centerline as shown in Figure C-14;

g = 24 in. (610 mm) minimum;

h = 17.5 in. (445 mm) minimum; and

j = 2.0 in. (51 mm) measured from the outer periphery of the steering wheel.

(ii) The protective structure and connecting fasteners must pass the static or dynamic tests described in paragraphs (d)(2), (d)(3), or (d)(4) of this section at a metal temperature of 0°F (-8°C) or below, or exhibit Charpy V-notch impact strengths as follows:

10-mm \times 10-mm (0.394-in. \times 0.394-in.) specimen: 8.0 ft-lb (10.8 J) at -20°F (-30°C);

10-mm \times 7.5-mm (0.394-in. \times 0.296-in.) specimen: 7.0 ft-lb (9.5 J) at -20°F (-30°C);

10-mm \times 5-mm (0.394-in. \times 0.197-in.) specimen: 5.5 ft-lb (7.5 J) at -20°F (-30°C); or

10-mm \times 2.5-mm (0.394-in. \times 0.098-in.) specimen: 4.0 ft-lb (5.5 J) at -20°F (-30°C).

Specimens shall be longitudinal and taken from flat stock, tubular, or structural sections before forming or welding for use in the protective enclosure. Specimens from tubular or structural sections shall be taken from the middle of the side of greatest dimension, not to include welds.

(iii) The following provisions address glazing requirements.

(A) Glazing shall conform to the requirements contained in Society of Automotive Engineers ("SAE") standard J674-1963 ("Safety glazing materials"), which is incorporated by reference. The incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51.

(B) SAE standard J674-1963 appears in the 1965 SAE Handbook, or it may be examined at: any OSHA Regional Office; the OSHA Docket Office, U.S. Department of Labor, 200 Constitution Avenue, NW., Room N-2625, Washington, DC 20210 (telephone: (202) 693-2350 (TTY number: (877) 889-5627)); or the National Archives and Records Administration ("NARA"). (For information on the availability of this material at NARA, telephone (202) 741-6030 or access the NARA Web site at http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.) Copies may be purchased from the Society of Automotive

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Engineers, 400 Commonwealth Drive, Warrendale, Pennsylvania 15096-0001.

(iv) Two or more operator exits shall be provided and positioned to avoid the possibility of both being blocked by the same accident.

(2) *Static test-performance requirements.* In addition to meeting the requirements of paragraph (e)(1) of this section for both side and rear loads, FER_{is} and FER_{ir} shall be greater than 1.0.

(3) *Dynamic test-performance requirements.* The structural requirements shall be met when the dimensions in paragraph (e)(1) of this section are used in both side and rear loads.

(4) *Field-upset test performance requirements.* The requirements of paragraph (e)(1) of this section shall be met for both side and rear upsets.

[70 FR 77004, Dec. 29, 2005, as amended at 71 FR 41145, July 20, 2006]

APPENDIX A TO SUBPART C OF PART 1928—EMPLOYEE OPERATING INSTRUCTIONS

1. Securely fasten your seat belt if the tractor has a ROPS.
2. Where possible, avoid operating the tractor near ditches, embankments, and holes.
3. Reduce speed when turning, crossing slopes, and on rough, slick, or muddy surfaces.
4. Stay off slopes too steep for safe operation.
5. Watch where you are going, especially at row ends, on roads, and around trees.
6. Do not permit others to ride.
7. Operate the tractor smoothly—no jerky turns, starts, or stops.
8. Hitch only to the drawbar and hitch points recommended by tractor manufacturers.
9. When tractor is stopped, set brakes securely and use park lock if available.

APPENDIX B TO SUBPART C OF PART 1928—FIGURES C-1 THROUGH C-16

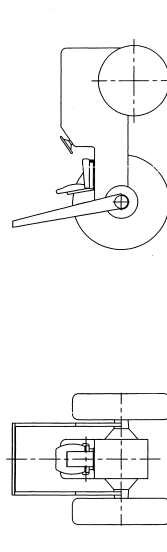


FIGURE C-1 - TRACTOR WITH TYPICAL PROTECTIVE FRAME.

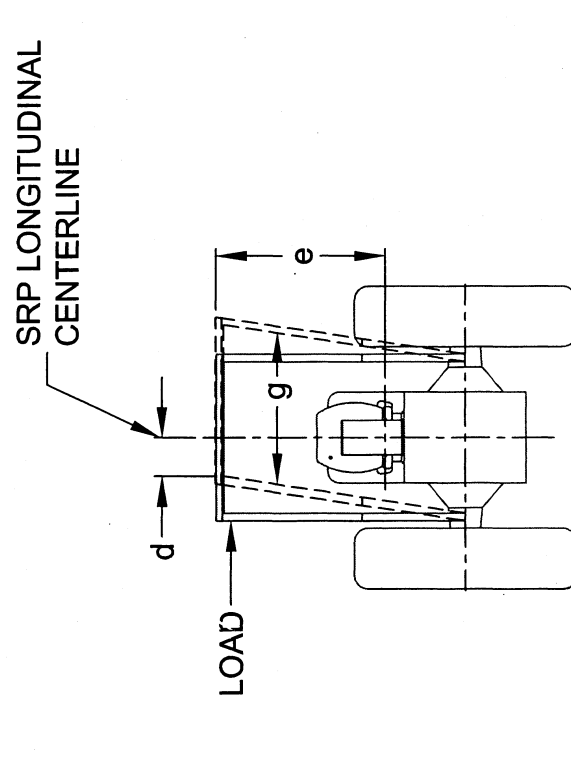


FIGURE C-2 - SIDE LOAD APPLICATION.

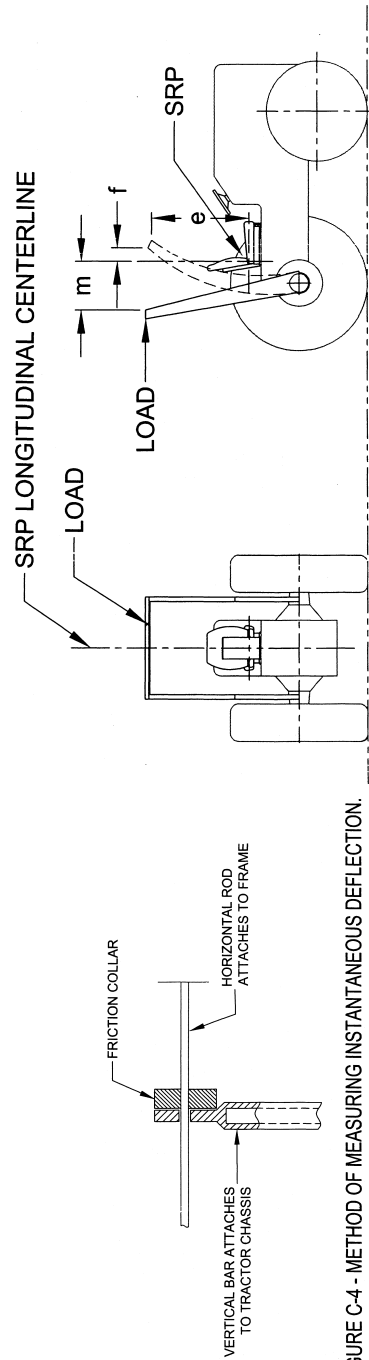


FIGURE C-3 - REAR LOAD APPLICATION.

FIGURE C-4 - METHOD OF MEASURING INSTANTANEOUS DEFLECTION.

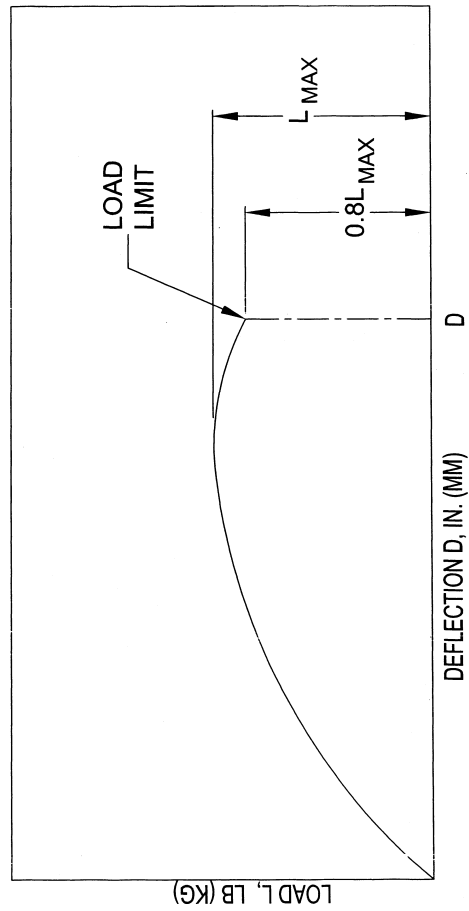


FIGURE C-5 - TYPICAL L-D DIAGRAM.

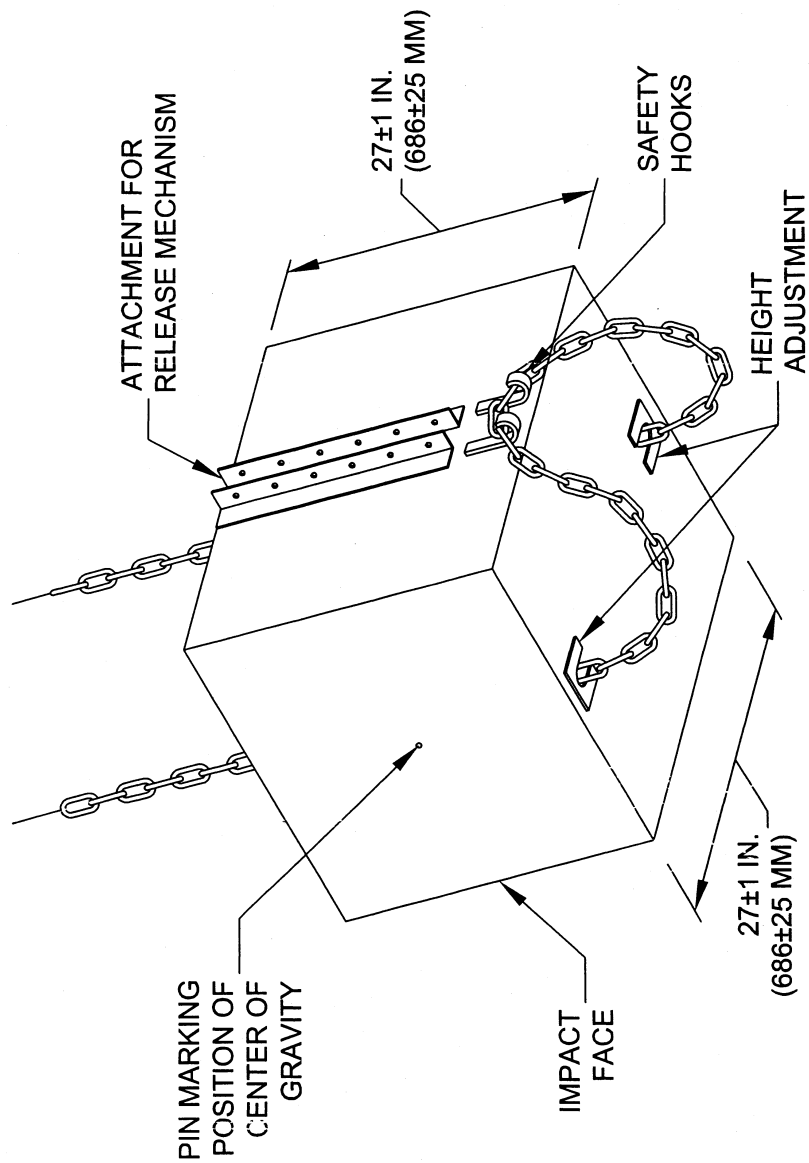
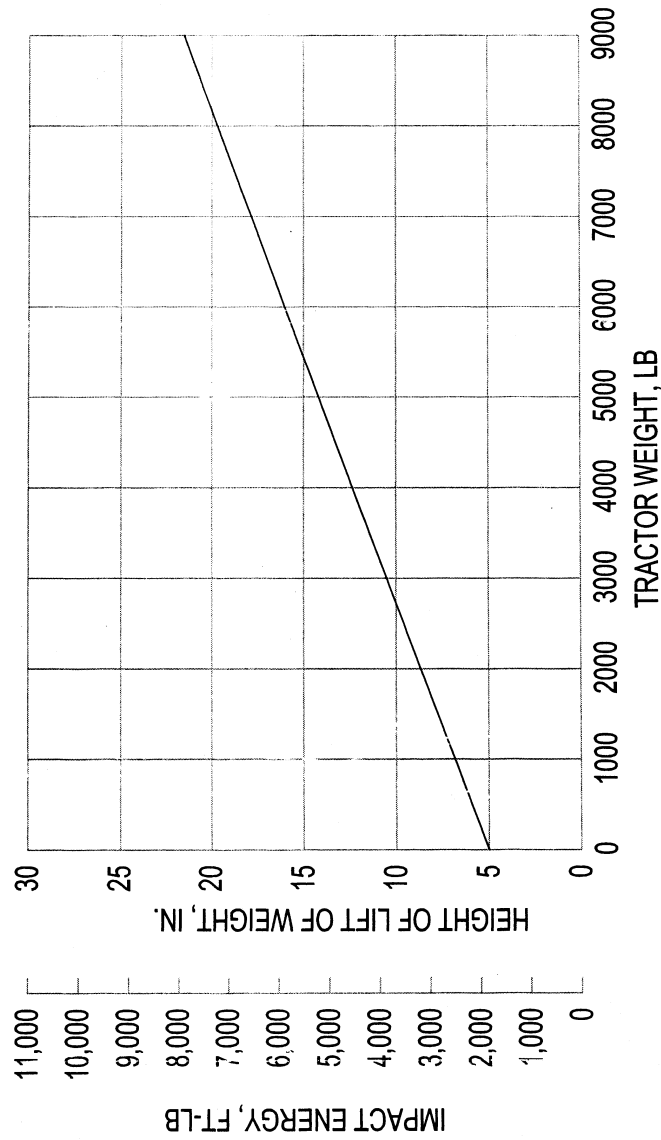


FIGURE C-6 - PENDULUM.



NOTATION OF FORMULAE

$$H = 4.92 + 0.00190W \text{ or } H' = 125 + 0.107W'$$

$$W = \text{tractor weight specified by 29 CFR 1928.51(a) in lbs (W' in kg).}$$

**FIGURE C-7 - IMPACT ENERGY AND CORRESPONDING
LIFT HEIGHT OF 4,410 LB (2,000 kg) WEIGHT.**

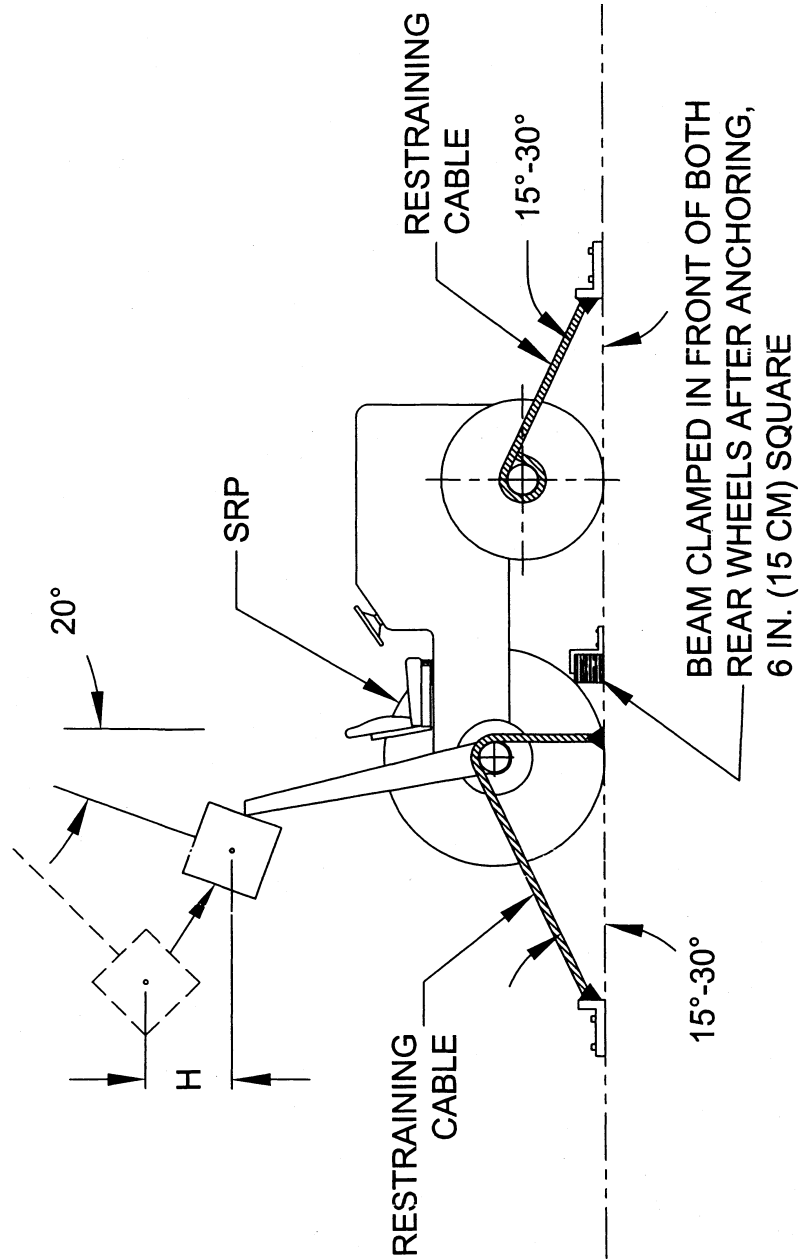


FIGURE C-8 - REAR IMPACT APPLICATION.

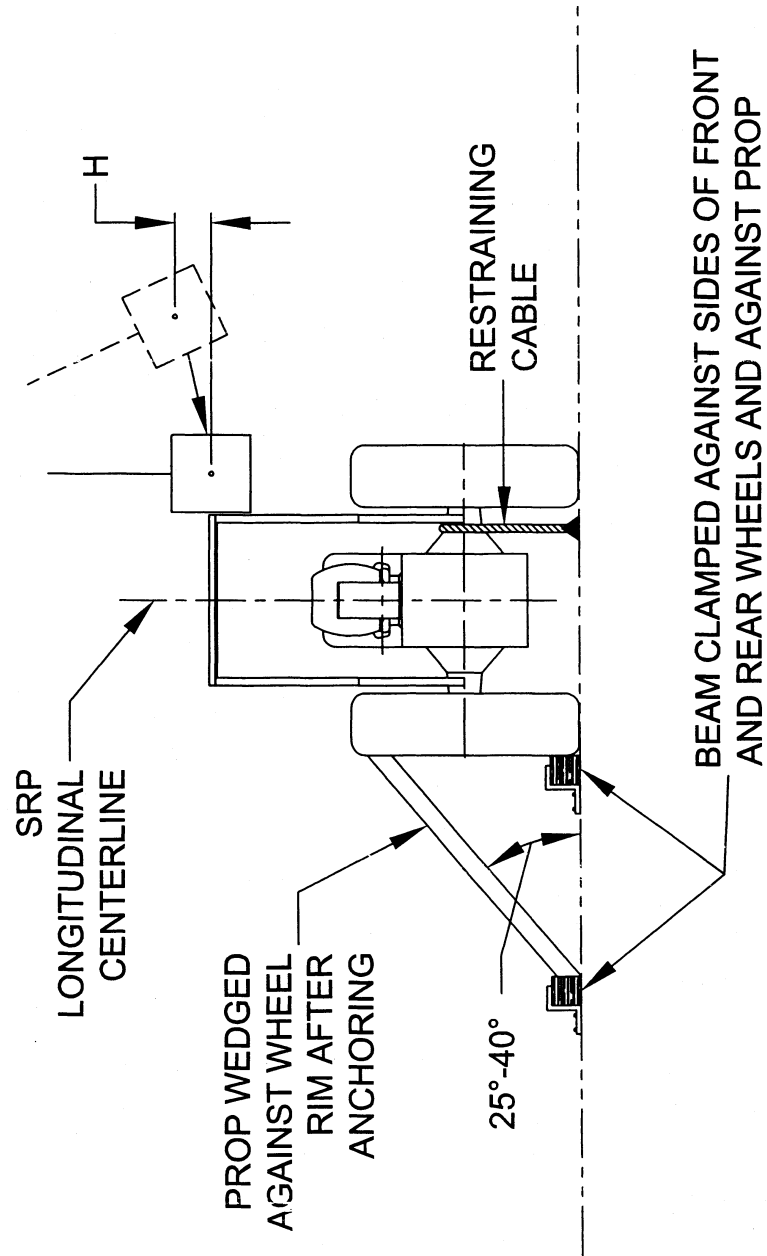


FIGURE C-9 - SIDE IMPACT APPLICATION.

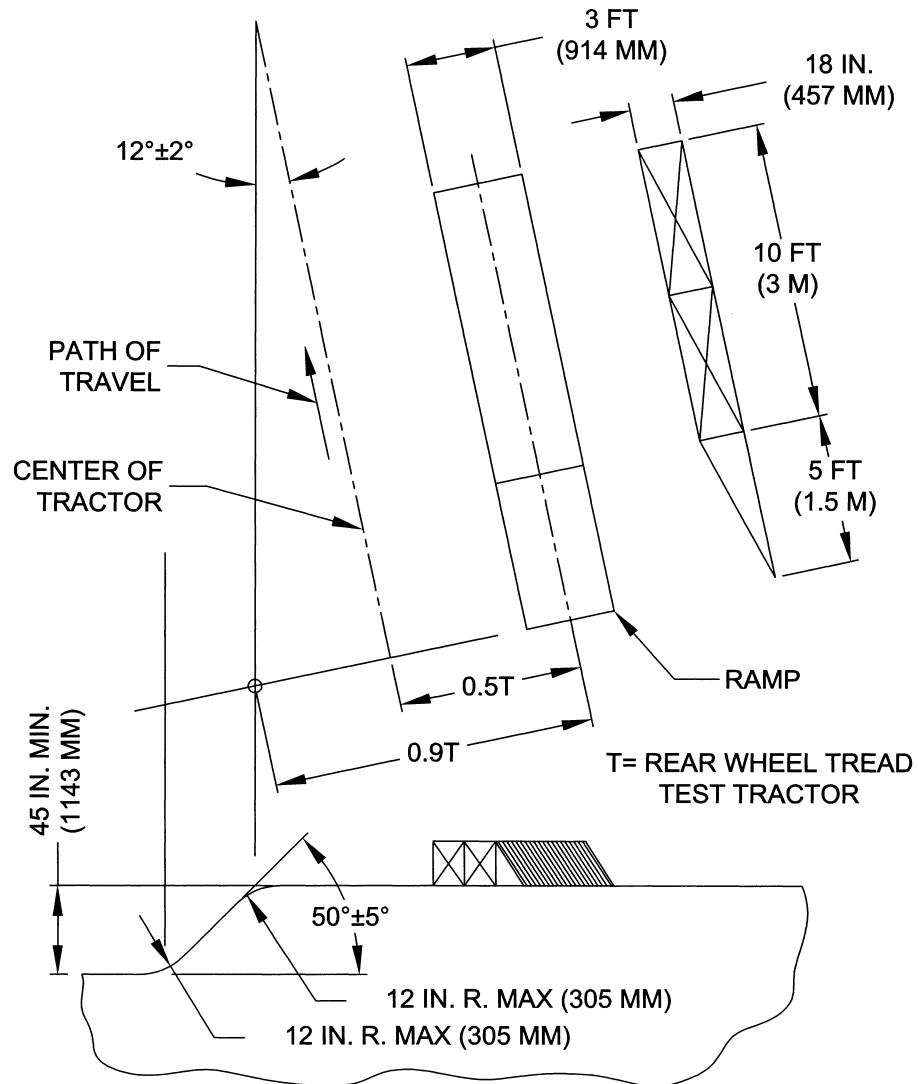


FIGURE C-10 - SIDE OVERTURN BANK AND RAMP.

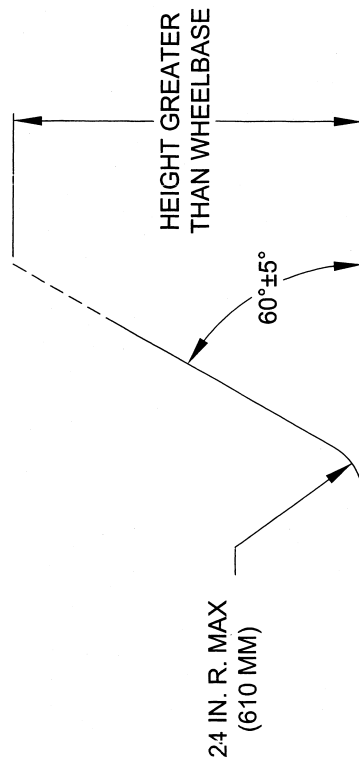


FIGURE C-11 - TYPICAL REAR OVERTURN BANK.

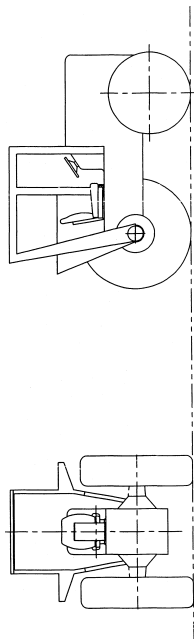


FIGURE C-12 - TRACTOR WITH TYPICAL
PROTECTIVE ENCLOSURE.



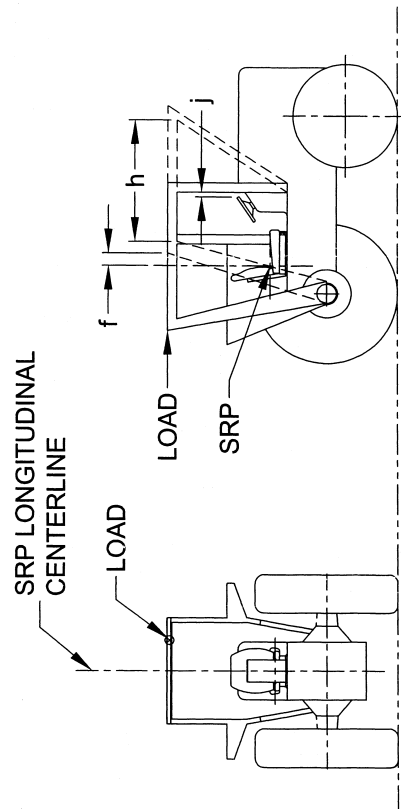


FIGURE C-14 - REAR LOAD APPLICATION.

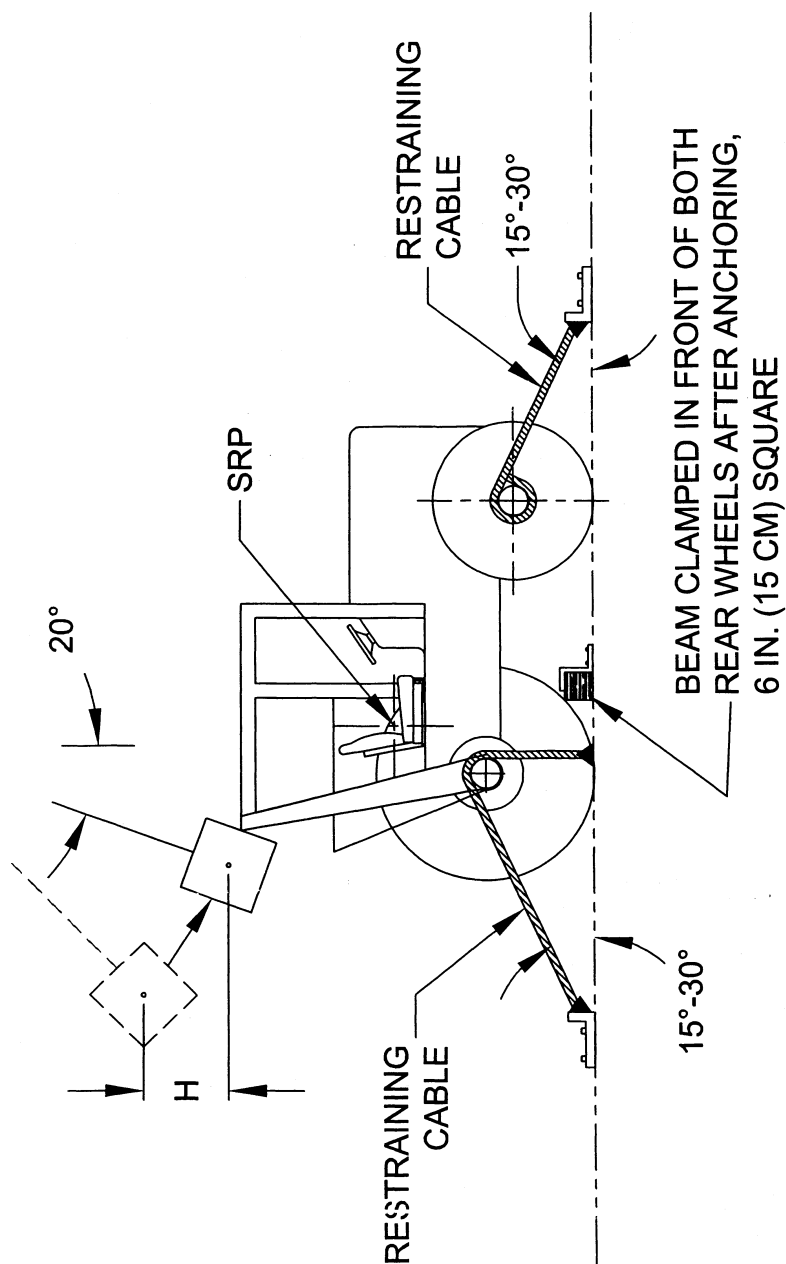


FIGURE C-15 - REAR IMPACT APPLICATION.

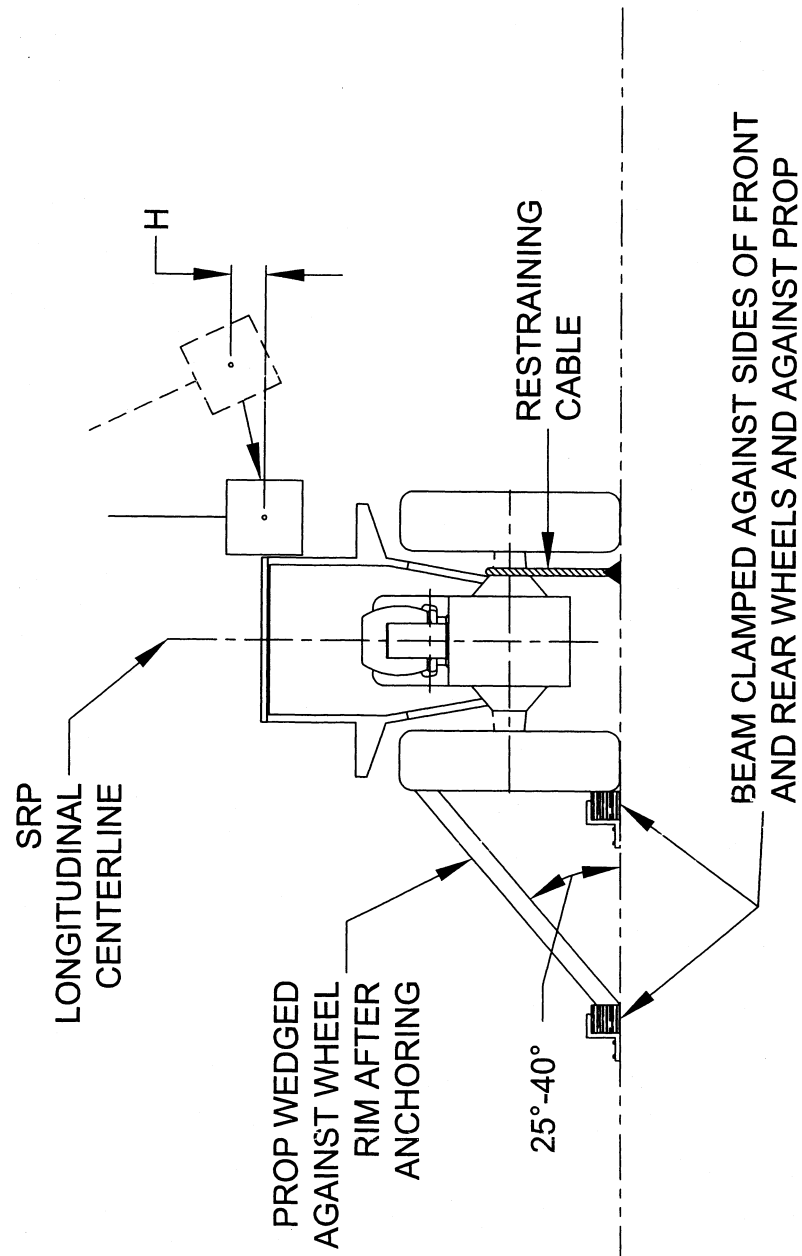


FIGURE C-16 - SIDE IMPACT APPLICATION.

[71 FR 41146, July 20, 2006]

Subpart D—Safety for Agricultural Equipment

§ 1928.57 Guarding of farm field equipment, farmstead equipment, and cotton gins.

(a) *General*—(1) *Purpose*. The purpose of this section is to provide for the protection of employees from the hazards associated with moving machinery parts of farm field equipment, farmstead equipment, and cotton gins used in any agricultural operation.

(2) *Scope*. Paragraph (a) of this section contains general requirements which apply to all covered equipment. In addition, paragraph (b) of this section applies to farm field equipment, paragraph (c) of this section applies to farmstead equipment, and paragraph (d) of this section applies to cotton gins.

(3) *Application*. This section applies to all farm field equipment, farmstead equipment, and cotton gins, except that paragraphs (b)(2), (b)(3), and (b)(4)(ii)(A), and (c)(2), (c)(3), and (c)(4)(ii)(A) do not apply to equipment manufactured before October 25, 1976.

(4) *Effective date*. This section takes effect on October 25, 1976, except that paragraph (d) of this section is effective on June 30, 1977.

(5) *Definitions*—*Cotton gins* are systems of machines which condition seed cotton, separate lint from seed, convey materials, and package lint cotton.

Farm field equipment means tractors or implements, including self-propelled implements, or any combination thereof used in agricultural operations.

Farmstead equipment means agricultural equipment normally used in a stationary manner. This includes, but is not limited to, materials handling equipment and accessories for such equipment whether or not the equipment is an integral part of a building.

Ground driven components are components which are powered by the turning motion of a wheel as the equipment travels over the ground.

A *guard* or *shield* is a barrier designed to protect against employee contact with a hazard created by a moving machinery part.

Power take-off shafts are the shafts and knuckles between the tractor, or other power source, and the first gear set, pulley, sprocket, or other components on power take-off shaft driven equipment.

(6) *Operating instructions*. At the time of initial assignment and at least annually thereafter, the employer shall instruct every employee in the safe operation and servicing of all covered equipment with which he is or will be involved, including at least the following safe operating practices:

(i) Keep all guards in place when the machine is in operation;

(ii) Permit no riders on farm field equipment other than persons required for instruction or assistance in machine operation;

(iii) Stop engine, disconnect the power source, and wait for all machine movement to stop before servicing, adjusting, cleaning, or unclogging the equipment, except where the machine must be running to be properly serviced or maintained, in which case the employer shall instruct employees as to all steps and procedures which are necessary to safely service or maintain the equipment;

(iv) Make sure everyone is clear of machinery before starting the engine, engaging power, or operating the machine;

(v) Lock out electrical power before performing maintenance or service on farmstead equipment.

(7) *Methods of guarding*. Except as otherwise provided in this subpart, each employer shall protect employees from coming into contact with hazards created by moving machinery parts as follows:

(i) Through the installation and use of a guard or shield or guarding by location;

(ii) Whenever a guard or shield or guarding by location is infeasible, by using a guardrail or fence.

(8) *Strength and design of guards*. (i) Where guards are used to provide the protection required by this section, they shall be designed and located to protect against inadvertent contact with the hazard being guarded.

(ii) Unless otherwise specified, each guard and its supports shall be capable of withstanding the force that a 250

pound individual, leaning on or falling against the guard, would exert upon that guard.

(iii) Guards shall be free from burrs, sharp edges, and sharp corners, and shall be securely fastened to the equipment or building.

(9) *Guarding by location.* A component is guarded by location during operation, maintenance, or servicing when, because of its location, no employee can inadvertently come in contact with the hazard during such operation, maintenance, or servicing. Where the employer can show that any exposure to hazards results from employee conduct which constitutes an isolated and unforeseeable event, the component shall also be considered guarded by location.

(10) *Guarding by railings.* Guardrails or fences shall be capable of protecting against employees inadvertently entering the hazardous area.

(11) *Servicing and maintenance.* Whenever a moving machinery part presents a hazard during servicing or maintenance, the engine shall be stopped, the power source disconnected, and all machine movement stopped before servicing or maintenance is performed, except where the employer can establish that:

(i) The equipment must be running to be properly serviced or maintained;

(ii) The equipment cannot be serviced or maintained while a guard or guards otherwise required by this standard are in place; and

(iii) The servicing or maintenance can be safely performed.

(b) *Farm field equipment—*(1) *Power take-off guarding.* (i) All power take-off shafts, including rear, mid- or side-mounted shafts, shall be guarded either by a master shield, as provided in paragraph (b)(1)(ii) of this section, or by other protective guarding.

(ii) All tractors shall be equipped with an agricultural tractor master shield on the rear power take-off except where removal of the tractor master shield is permitted by paragraph (b)(1)(iii) of this section. The master shield shall have sufficient strength to prevent permanent deformation of the shield when a 250 pound operator mounts or dismounts the tractor using the shield as a step.

(iii) Power take-off driven equipment shall be guarded to protect against employee contact with positively driven rotating members of the power drive system. Where power take-off driven equipment is of a design requiring removal of the tractor master shield, the equipment shall also include protection from that portion of the tractor power take-off shaft which protrudes from the tractor.

(iv) Signs shall be placed at prominent locations on tractors and power take-off driven equipment specifying that power drive system safety shields must be kept in place.

(2) *Other power transmission components.* (i) The mesh or nip-points of all power driven gears, belts, chains, sheaves, pulleys, sprockets, and idlers shall be guarded.

(ii) All revolving shafts, including projections such as bolts, keys, or set screws, shall be guarded, except smooth shaft ends protruding less than one-half the outside diameter of the shaft and its locking means.

(iii) Ground driven components shall be guarded in accordance with paragraphs (b)(2)(i) and (b)(2)(ii) of this section if any employee may be exposed to them while the drives are in motion.

(3) *Functional components.* Functional components, such as snapping or husking rolls, straw spreaders and choppers, cutterbars, flail rotors, rotary beaters, mixing augers, feed rolls, conveying augers, rotary tillers, and similar units, which must be exposed for proper function, shall be guarded to the fullest extent which will not substantially interfere with normal functioning of the component.

(4) *Access to moving parts.* (i) Guards, shields, and access doors shall be in place when the equipment is in operation.

(ii) Where removal of a guard or access door will expose an employee to any component which continues to rotate after the power is disengaged, the employer shall provide, in the immediate area, the following:

(A) A readily visible or audible warning of rotation; and

(B) A safety sign warning the employee to:

(I) Look and listen for evidence of rotation; and

(2) Not remove the guard or access door until all components have stopped.

(c) *Farmstead equipment*—(1) *Power take-off guarding*. (i) All power take-off shafts, including rear, mid-, or side-mounted shafts, shall be guarded either by a master shield as provided in paragraph (b)(1)(ii) of this section or other protective guarding.

(ii) Power take-off driven equipment shall be guarded to protect against employee contact with positively driven rotating members of the power drive system. Where power take-off driven equipment is of a design requiring removal of the tractor master shield, the equipment shall also include protection from that portion of the tractor power take-off shaft which protrudes from the tractor.

(iii) Signs shall be placed at prominent locations on power take-off driven equipment specifying that power drive system safety shields must be kept in place.

(2) *Other power transmission components*. (i) The mesh or nip-points of all power driven gears, belts, chains, sheaves, pulleys, sprockets, and idlers shall be guarded.

(ii) All revolving shafts, including projections such as bolts, keys, or set screws, shall be guarded, with the exception of:

(A) Smooth shafts and shaft ends (without any projecting bolts, keys, or set screws), revolving at less than 10 rpm, on feed handling equipment used on the top surface of materials in bulk storage facilities; and

(B) Smooth shaft ends protruding less than one-half the outside diameter of the shaft and its locking means.

(3) *Functional components*. (i) Functional components, such as choppers, rotary beaters, mixing augers, feed rolls, conveying augers, grain spreaders, stirring augers, sweep augers, and feed augers, which must be exposed for proper function, shall be guarded to the fullest extent which will not substantially interfere with the normal functioning of the component.

(ii) Sweep arm material gathering mechanisms used on the top surface of materials within silo structures shall be guarded. The lower or leading edge of the guard shall be located no more

than 12 inches above the material surface and no less than 6 inches in front of the leading edge of the rotating member of the gathering mechanism. The guard shall be parallel to, and extend the fullest practical length of, the material gathering mechanism.

(iii) Exposed auger flighting on portable grain augers shall be guarded with either grating type guards or solid baffle style covers as follows:

(A) The largest dimensions or openings in grating type guards through which materials are required to flow shall be $4\frac{3}{4}$ inches. The area of each opening shall be no larger than 10 square inches. The opening shall be located no closer to the rotating flighting than $2\frac{1}{2}$ inches.

(B) Slotted openings in solid baffle style covers shall be no wider than $1\frac{1}{2}$ inches, or closer than $3\frac{1}{2}$ inches to the exposed flighting.

(4) *Access to moving parts*. (i) Guards, shields, and access doors shall be in place when the equipment is in operation.

(ii) Where removal of a guard or access door will expose an employee to any component which continues to rotate after the power is disengaged, the employer shall provide, in the immediate area, the following:

(A) A readily visible or audible warning of rotation; and

(B) A safety sign warning the employee to:

(1) Look and listen for evidence of rotation; and

(2) Not remove the guard or access door until all components have stopped.

(5) *Electrical disconnect means*. (i) Application of electrical power from a location not under the immediate and exclusive control of the employee or employees maintaining or servicing equipment shall be prevented by:

(A) Providing an exclusive, positive locking means on the main switch which can be operated only by the employee or employees performing the maintenance or servicing; or

(B) In the case of material handling equipment located in a bulk storage structure, by physically locating on the equipment an electrical or mechanical means to disconnect the power.

(ii) All circuit protection devices, including those which are an integral part of a motor, shall be of the manual reset type, except where:

(A) The employer can establish that because of the nature of the operation, distances involved, and the amount of time normally spent by employees in the area of the affected equipment, use of the manual reset device would be infeasible;

(B) There is an electrical disconnect switch available to the employee within 15 feet of the equipment upon which maintenance or service is being performed; and

(C) A sign is prominently posted near each hazardous component which warns the employee that, unless the electrical disconnect switch is utilized, the motor could automatically reset while the employee is working on the hazardous component.

(d) *Cotton ginning equipment*—(1) *Power transmission components.* (i) The main drive and miscellaneous drives of gin stands shall be completely enclosed, guarded by location, or guarded by railings (consistent with the requirements of paragraph (a)(7) of this section). Drives between gin stands shall be guarded so as to prevent access to the area between machines.

(ii) When guarded by railings, any hazardous component within 15 horizontal inches of the rail shall be completely enclosed. Railing height shall be approximately 42 inches off the floor, platform, or other working surface, with a midrail between the top-rail and the working surface. Panels made of materials conforming to the requirements in Table D–1, or equivalent, may be substituted for midrails. Guardrails shall be strong enough to withstand at least 200 pounds force on the toprail.

(iii) Belts guarded by railings shall be inspected for defects at least daily. The machinery shall not be operated until all defective belts are replaced.

TABLE D–1—EXAMPLES OF MINIMUM REQUIREMENTS FOR GUARD PANEL MATERIALS

Material	Clearance from moving part at all points (in inches)	Largest mesh or opening allowable (in inches)	Minimum gage (U.S. standard) or thickness
Woven wire	Under 2	$\frac{3}{8}$	16

TABLE D–1—EXAMPLES OF MINIMUM REQUIREMENTS FOR GUARD PANEL MATERIALS—Continued

Material	Clearance from moving part at all points (in inches)	Largest mesh or opening allowable (in inches)	Minimum gage (U.S. standard) or thickness
Expanded metal	2 to 4	$\frac{1}{2}$	16
	4 to 15	2	12
	Under 4	$\frac{1}{2}$	18
Perforated metal.	4 to 15	2	13
	Under 4	$\frac{1}{2}$	20
Sheet metal	4 to 15	2	14
	Under 4	22
Plastic	4 to 15	22
	Under 4	(¹)
	4 to 15	(¹)

¹ Tensile strength of 10,000 lb/in²

(iv) Pulleys of V-belt drives shall be completely enclosed or guarded by location whether or not railings are present. The open end of the pulley guard shall be not less than 4 inches from the periphery of the pulleys.

(v) Chains and sprockets shall be completely enclosed, except that they may be guarded by location if the bearings are packed or if accessible extension lubrication fittings are used.

(vi) Where complete enclosure of a component is likely to cause a fire hazard due to excessive deposits of lint, only the face section of nip-point and pulley guards is required. The guard shall extend at least 6 inches beyond the rim of the pulley on the in-running and off-running sides of the belt, and at least 2 inches from the rim and face of the pulley in all other directions.

(vii) Projecting shaft ends not guarded by location shall present a smooth edge and end, shall be guarded by non-rotating caps or safety sleeves, and may not protrude more than one-half the outside diameter of the shaft.

(viii) In power plants and power development rooms where access is limited to authorized personnel, guard railings may be used in place of guards or guarding by location. Authorized employees having access to power plants and power development rooms shall be instructed in the safe operation and maintenance of the equipment in accordance with paragraph (a)(6) of this section.

(2) *Functional components.* (i) Gin stands shall be provided with a permanently installed guard designed to preclude contact with the gin saws while

in motion. The saw blades in the roll box shall be considered guarded by location if they do not extend through the ginning ribs into the roll box when the breast is in the out position.

(ii) Moving saws on lint cleaners which have doors giving access to the saws shall be guarded by fixed barrier guards or their equivalent which prevent direct finger or hand contact with the saws while the saws are in motion.

(iii) An interlock shall be installed on all balers so that the upper gates cannot be opened while the tramper is operating.

(iv) Top panels of burr extractors shall be hinged and equipped with a sturdy positive latch.

(v) All accessible screw conveyors shall be guarded by substantial covers or gratings, or with an inverted horizontally slotted guard of the trough type, which will prevent employees from coming into contact with the screw conveyor. Such guards may consist of horizontal bars spaced so as to allow material to be fed into the conveyor, and supported by arches which are not more than 8 feet apart. Screw conveyors under gin stands shall be considered guarded by location.

(3) *Warning device.* A warning device shall be installed in all gins to provide an audible signal which will indicate to employees that any or all of the machines comprising the gin are about to be started. The signal shall be of sufficient volume to be heard by employees, and shall be sounded each time before starting the gin.

[41 FR 10195, Mar. 9, 1976; 41 FR 11022, Mar. 16, 1976; 41 FR 22268, June 2, 1976, as amended at 41 FR 46598, Oct. 22, 1976]

Subparts E-H [Reserved]

Subpart I—General Environmental Controls

§ 1928.110 Field sanitation.

(a) *Scope.* This section shall apply to any agricultural establishment where eleven (11) or more employees are engaged on any given day in hand-labor operations in the field.

(b) *Definitions.* *Agricultural employer* means any person, corporation, association, or other legal entity that:

(i) Owns or operates an agricultural establishment;

(ii) Contracts with the owner or operator of an agricultural establishment in advance of production for the purchase of a crop and exercises substantial control over production; or

(iii) Recruits and supervises employees or is responsible for the management and condition of an agricultural establishment.

Agricultural establishment is a business operation that uses paid employees in the production of food, fiber, or other materials such as seed, seedlings, plants, or parts of plants.

Hand-labor operations means agricultural activities or agricultural operations performed by hand or with hand tools. Except for purposes of paragraph (c)(2)(iii) of this section, *hand-labor operations* also include other activities or operations performed in conjunction with hand labor in the field. Some examples of *hand-labor operations* are the hand-cultivation, hand-weeding, hand-planting and hand-harvesting of vegetables, nuts, fruits, seedlings or other crops, including mushrooms, and the hand packing of produce into containers, whether done on the ground, on a moving machine or in a temporary packing shed located in the field. *Hand-labor* does not include such activities as logging operations, the care or feeding of livestock, or hand-labor operations in permanent structures (e.g., canning facilities or packing houses).

Handwashing facility means a facility providing either a basin, container, or outlet with an adequate supply of potable water, soap and single-use towels.

Potable water means water that meets the standards for drinking purposes of the State or local authority having jurisdiction, or water that meets the quality standards prescribed by the U.S. Environmental Protection Agency's National Primary Drinking Water Regulations (40 CFR part 141).

Toilet facility means a fixed or portable facility designed for the purpose of adequate collection and containment of the products of both defecation and urination which is supplied with toilet

paper adequate to employee needs. Toilet facility includes biological, chemical, flush and combustion toilets and sanitary privies.

(c) *Requirements.* Agricultural employers shall provide the following for employees engaged in hand-labor operations in the field, without cost to the employee:

(1) *Potable drinking water.* (i) Potable water shall be provided and placed in locations readily accessible to all employees.

(ii) The water shall be suitably cool and in sufficient amounts, taking into account the air temperature, humidity and the nature of the work performed, to meet the needs of all employees.

(iii) The water shall be dispensed in single-use drinking cups or by fountains. The use of common drinking cups or dippers is prohibited.

(2) *Toilet and handwashing facilities.*

(i) One toilet facility and one handwashing facility shall be provided for each twenty (20) employees or fraction thereof, except as stated in paragraph (c)(2)(v) of this section.

(ii) Toilet facilities shall be adequately ventilated, appropriately screened, have self-closing doors that can be closed and latched from the inside and shall be constructed to insure privacy.

(iii) Toilet and handwashing facilities shall be accessibly located and in close proximity to each other. The facilities shall be located within a one-quarter-mile walk of each hand laborer's place of work in the field.

(iv) Where due to terrain it is not feasible to locate facilities as required above, the facilities shall be located at the point of closest vehicular access.

(v) Toilet and handwashing facilities are not required for employees who perform field work for a period of three (3) hours or less (including transportation time to and from the field) during the day.

(3) *Maintenance.* Potable drinking water and toilet and handwashing facilities shall be maintained in accordance with appropriate public health sanitation practices, including the following:

(i) Drinking water containers shall be constructed of materials that maintain water quality, shall be refilled daily or

more often as necessary, shall be kept covered and shall be regularly cleaned.

(ii) Toilet facilities shall be operational and maintained in clean and sanitary condition.

(iii) Handwashing facilities shall be refilled with potable water as necessary to ensure an adequate supply and shall be maintained in a clean and sanitary condition; and

(iv) Disposal of wastes from facilities shall not cause unsanitary conditions.

(4) *Reasonable use.* The employer shall notify each employee of the location of the sanitation facilities and water and shall allow each employee reasonable opportunities during the workday to use them. The employer also shall inform each employee of the importance of each of the following good hygiene practices to minimize exposure to the hazards in the field of heat, communicable diseases, retention of urine and agrichemical residues:

(i) Use the water and facilities provided for drinking, handwashing and elimination;

(ii) Drink water frequently and especially on hot days;

(iii) Urinate as frequently as necessary;

(iv) Wash hands both before and after using the toilet; and

(v) Wash hands before eating and smoking.

(d) *Dates*—(1) *Effective date.* This standard shall take effect on May 30, 1987.

(2) *Startup dates.* Employers must comply with the requirements of paragraphs:

(i) Paragraph (c)(1), to provide potable drinking water, by May 30, 1987;

(ii) Paragraph (c)(2), to provide handwashing and toilet facilities, by July 30, 1987;

(iii) Paragraph (c)(3), to provide maintenance for toilet and handwashing facilities, by July 30, 1987; and

(iv) Paragraph (c)(4), to assure reasonable use, by July 30, 1987.

[52 FR 16095, May 1, 1987, as amended at 76 FR 33612, June 8, 2011]

Subparts J–L [Reserved]

Subpart M—Occupational Health**§ 1928.1027 Cadmium.**

See § 1910.1027, *Cadmium*.

[61 FR 9255, Mar. 7, 1996]

**PART 1949—OFFICE OF TRAINING
AND EDUCATION, OCCUPA-
TIONAL SAFETY AND HEALTH AD-
MINISTRATION**

Subpart A—OSHA Training Institute

Sec.

1949.1 Policy regarding tuition fees.

1949.2 Definitions.

1949.3 Schedule of fees.

1949.4 Procedure for payment.

1949.5 Refunds.

AUTHORITY: Secs. 8, 26, Occupational Safety and Health Act of 1970 (29 U.S.C. 657, 670); 31 U.S.C. 9701; Secretary of Labor's Order No. 9-83 (48 FR 35736).

SOURCE: 49 FR 32066, Aug. 10, 1984, unless otherwise noted.

Subpart A—OSHA Training Institute**§ 1949.1 Policy regarding tuition fees.**

(a) The OSHA Training Institute shall charge tuition fees for all private sector students attending Institute courses.

(b) The following private sector students shall be exempt from the payment of tuition fees.

(1) Associate members of Field Federal Safety and Health Councils.

(2) Students who are representatives of foreign governments.

(3) Students attending courses which are required by OSHA for the student to maintain an existing designation of OSHA certified outreach trainer.

(c) Additional exemptions may be made by the Director of the OSHA Training Institute on a case by case basis if it is determined that the students exempted are employed by a non-profit organization and the granting of an exemption from tuition would be in the best interest of the occupational safety and health program. Individuals or organizations wishing to be considered for this exemption shall make application to the Director of the OSHA Training Institute in writing stating

the reasons for an exemption from payment of tuition.

[56 FR 28076, June 19, 1991]

§ 1949.2 Definitions.

Any term not defined herein shall have the same meaning as given it in the Act. As used in this subpart:

Private sector students means those students attending the Institute who are not employees of Federal, State, or local governments.

§ 1949.3 Schedule of fees.

(a) Tuition fees will be computed on the basis of the cost to the Government for the Institute conduct of the course, as determined by the Director of the Institute.

(b) Total tuition charges for each course will be set forth in the course announcement.

§ 1949.4 Procedure for payment.

(a) Applications for Institute courses shall be submitted to the Institute Registrar's office in accordance with instructions issued by the Institute.

(b) Private sector personnel shall, upon notification of their acceptance by the Institute, submit a check payable to "U.S. Department of Labor" in the amount indicated by the course announcement prior to the commencement of the course.

§ 1949.5 Refunds.

An applicant may withdraw an application and receive full reimbursement of the fee provided that written notification to the Institute Registrar is mailed no later than 14 days before the commencement of the course for which registration has been submitted.

**PART 1952—APPROVED STATE
PLANS FOR ENFORCEMENT OF
STATE STANDARDS**

**Subpart A—List of Approved State Plans for
Private-Sector and State and Local
Government Employees**

Sec.

1952.1 South Carolina.

1952.2 Oregon.

1952.3 Utah.

1952.4 Washington.

1952.5 North Carolina.